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Capital Structure and Firm Performance

- A case of Iran -

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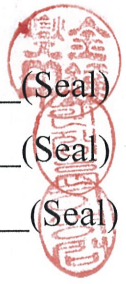

Capital Structure and Firm Performance

-A case of Iran-

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Abstract

This study aims to address the relationship between capital structure and financial performance of 22 Iranian petrochemical complexes listed on the Iran's securities and exchange organization over a period of seven-years (2011-2017). This study is based on the panel data analysis. Return on equity and return on assets are chosen as the measures of the complexes effectiveness while long-term debt, short-term debt, total debt and total equity are considered as the indicators of capital structure. The determinants of the capital structure in the manufacturing industry including inflation, risk, tangibility and liquidity are applied as control variables. The results indicate that debt has a positive impact on the return on equity and return on assets while total equity has a negative impact on them. The capital structure determinants show mix impacts on the profitability measures. Based on the current capital structure of Iranian petrochemical complexes and the results of this study, it is suggested that under certain

circumstances, the mentioned complexes increase long-term debt and decrease equity to boost their profitability.

Keywords: capital Structure, Firm Performance, Petrochemical Complex, Panel Data, Return on Asset, Iran

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Chapter I . Introduction

1. Study Background

A firm is not able to operate without capital, and debt ratio is the measure which absolutely specifies the firm's performance (She & Guo, 2018).

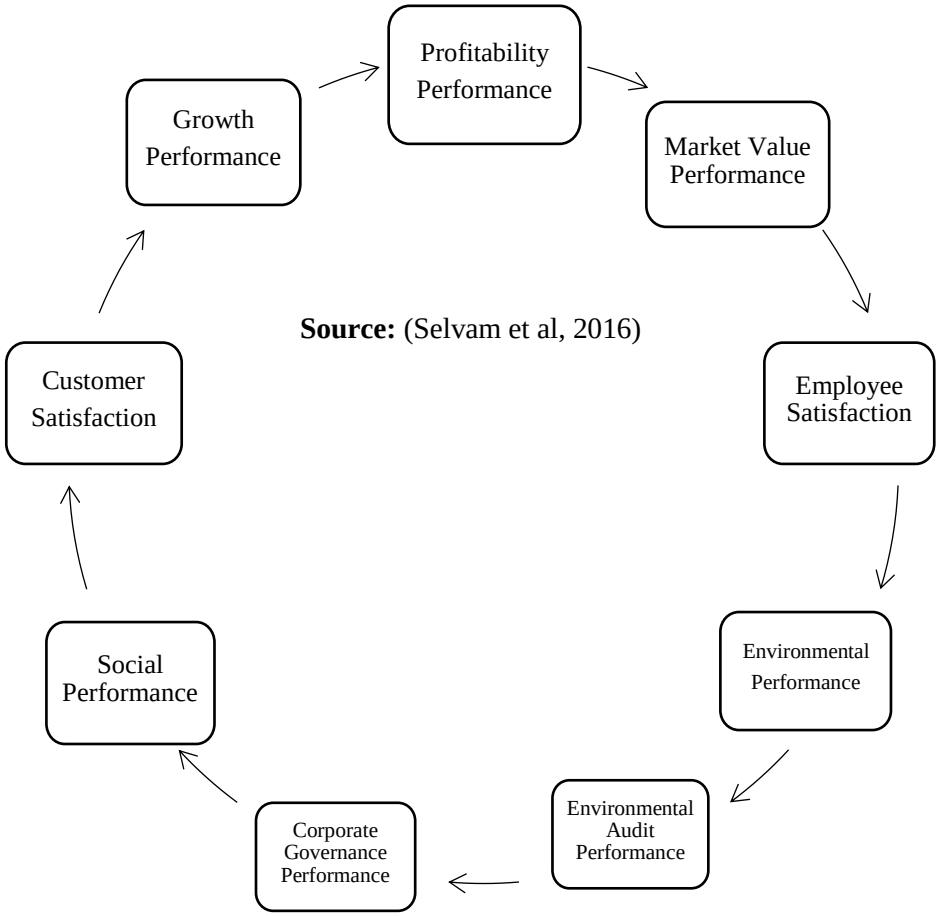
1-1. Firm Performance

The firm value increases through merging, operating, marketing, human resource and financial functions. Among these functions, financial function has the responsibility to budget and fund other functions, therefore, if the financial function has an optimal capital structure, consecutively the other functions will work properly altogether (Maneerattanarungrot & Donkwa, 2018). Any firm aims to make profit and maximize it. Accordingly, this profit will benefit the society and stakeholders too and that is why the stakeholders look forward the firm's financial performance enhancement and this improvement should be sustainable. The measures which determine the appropriateness and the profitability of the financial performance can have different criteria such as market value, accounting value or social performance. These are not the only criteria for the mentioned measure. Generally, profitability is the signal which companies apply to assess their financial performance. The higher the profit is, the better the financial performance will be. (Ha et al., 2019).

There is a misconception between organizational effectiveness and firm performance. Organizational effectiveness is a wide concept (Venkatraman & Ramanujam,, 1986) which incorporates all facets associated with the firm while firm performance is only a part of it. (Cameron, 1986).

Based on the reviews in regards to the firm performance determinants, the following construct is proposed:

Figure 1 Dimensions of the firm performance



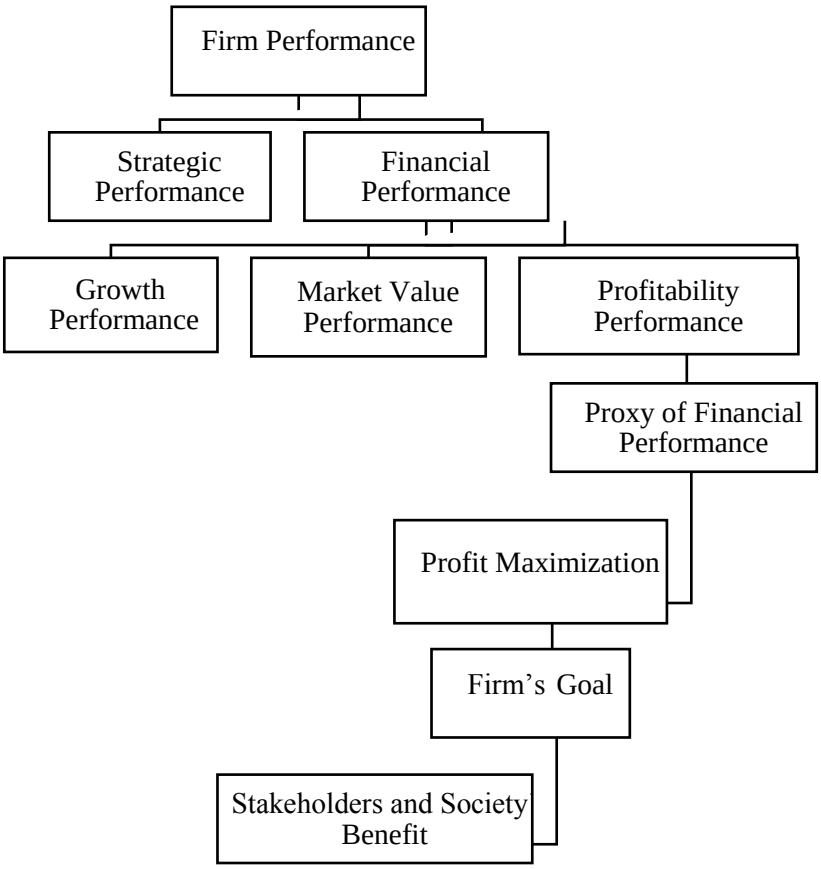
Source: (Selvam et al, 2016)

Since this study is going to focus on the capital structure of the firms, profitability performance will be explained as the main indicator of the firm performance in this part.

As it was indicated before, profitability performance simply refers to the capability of a company to make profit. When a firm generates revenue, after deducting all expenses, taxes and interests, pure profit remains. The shareholders and investors should be satisfied, their profit should get maximized and all these come from the excellent financial performance (Ramkumar et al, 2012) (Chakravarthy, 1986). Financial performance also can be determined by profitability, growth and market value (Cho & Pucik, 2005 and Venkatraman & Ramanujam, 1986). These three indicators are complementary (Miller, Glick & Cardinal, 2005).

There is another comprehensive model which divides the firm performance into two categories as is shown in figure 2:

Figure 2 Firm Performance categories



Source :(Selvam et al, 2016)

As it was remarked before, the focus of this study is one the financial performance, thus, only the financial performance part of this model will be explained. Financial performance includes three indicators called profitability performance, growth performance and market value performance. Since the profitability performance is the proxy of financial performance (Ha et al., 2019), the parameters of this indicator will

be assessed. There are six parameters or ratios which measure the profitability performance and they are showed in the table 1:

Table 1 Profitability Performance Parameters

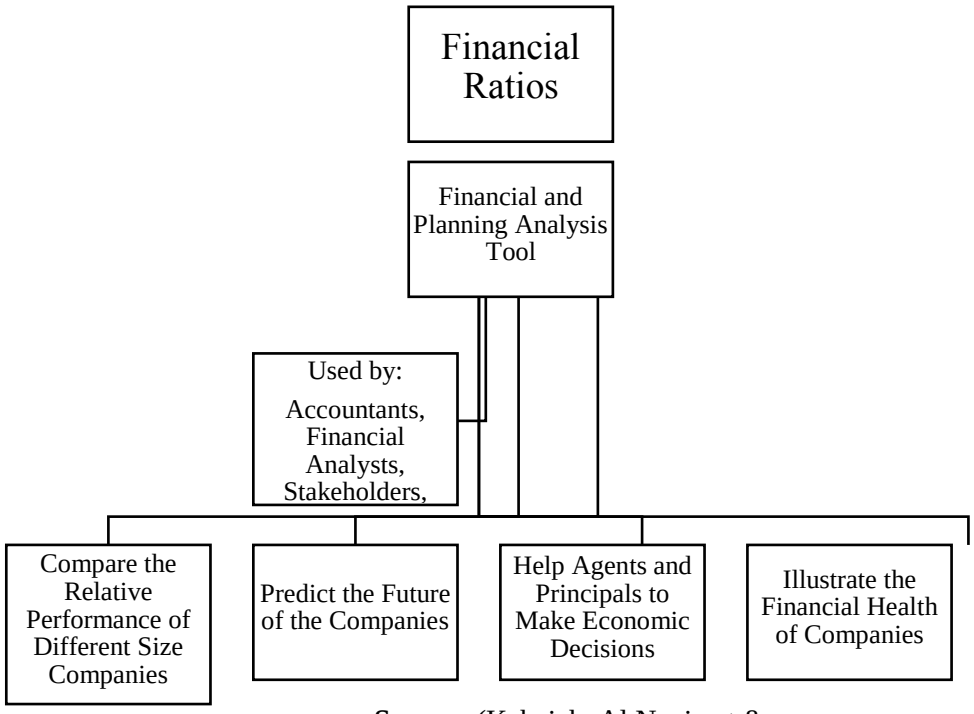
Dimension	Ratios/Parameters
Profitability Performance	ROA (Return on Asset)
	EBTIDA (Earnings before interest, taxes, depreciation, and amortization)
	ROI (Return on Investment)
	Net Income/ Revenue
	ROE (Return on Equity)
	EVA (Economic value Added)

Source: (Ha et al., 2019)

1-2. Financial Ratios

Financial ratios have been used from the time that firms started to assess their financial performance. This topic came into being in 19th and was used by financial agents like accountants and financial analysts. Applying the internal and external data in the financial ratios, firms could make economic decisions. A lot of financial models were proposed over the time but still the conventional ones are popular (Kabajeh, Al Nuaimat & Dahmash, 2012).

Figure 3 Financial Ratios Functions

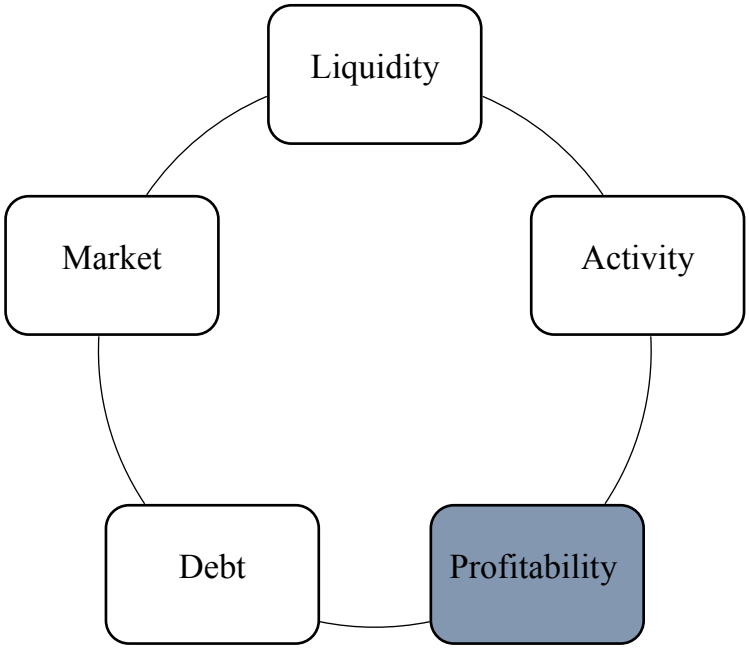


Source :(Kabajeh, Al Nuaimat & Dahmash, ,2012)

Figure 3 shows the functions of the financial ratios. They can be used by accountants, financial analyst (Kabajeh, Al Nuaimat & Dahmash, 2012) business analysts, creditors, investors and financial managers (Delen, Kuzey& Uyar, 2013) to plan and assess the financial issues (Kabajeh, Al Nuaimat & Dahmash, 2012). These ratios have many benefits such as, helping the stakeholders to know about the performance and growth of their firm (Delen, kuzey& Uyar, 2013), illustrating the most appropriate way of decision making for the agents and principal (Kabajeh, Al Nuaimat & Dahmash, 2012) and helping them to predict the future performance of the company (Altman, 1968,

Beaver, 1966). Also ratios are very useful tools to compare the companies relatively (Delen, Kuzey & Uyar, 2013).

Figure 4 Financial Ratios Categories



Source: (Kabajeh, Al Nuaimat & Dahmash, 2012).

As you can see in the figure 4, financial ratios can be divided into five categories (Kabajeh, Nuaimat & Dahmash, 2012).

As the case of this study is the firm's profitability, in this part only profitably ratios are explained. The general firm's productivity can be determined by profitability ratios. Profitability ratios show the revenue made by the firm. These ratios serve the stakeholders and investors to get aware of the firm's earning capacity (Kabajeh, Nuaimat & Dahmash, 2012).

According to the (Kabajeh, Nuaimat & Dahmash, 2012) there are three types of profitability ratios:

- Ratios of the return on assets (ROA)
- Ratios of the return on owner's equity (ROE)
- Ratios of return on investment (ROI)

They also emphasize that the most used ones are ROA and ROE ratios. You can find more on these ratios in the table 2:

Table 2 Profitability measures

Profitably Ratio	Ratio	Application
ROA	Net Profit/Total Assets	Shows the operating Efficiency
ROE	Net Profit/Total Shareholders Equity	Estimates the shareholders rate of return on their investment

Source: (Kabajeh, Nuaimat & Dahmash, 2012)

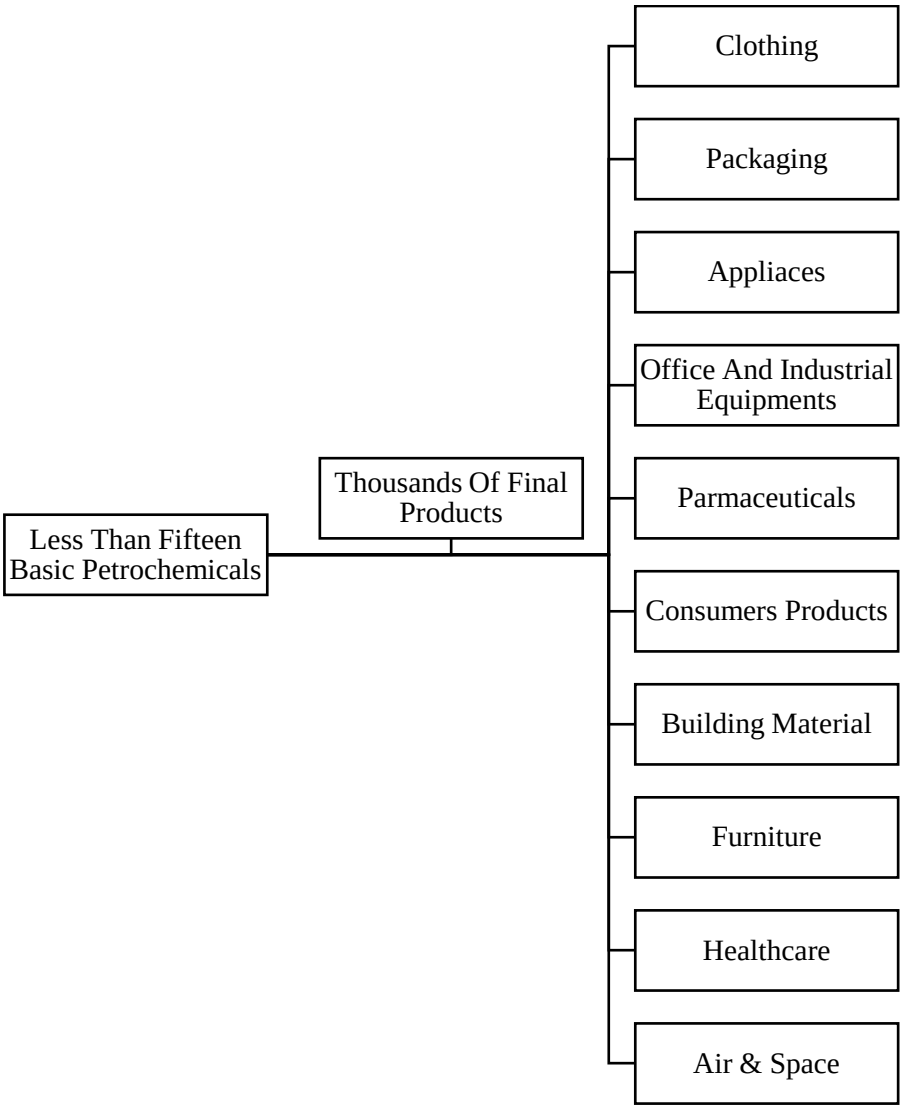
Chapter II. Petrochemical Industry

The industry which is active in the field of developing materials from petroleum and natural gas is called petrochemical industry. Petrochemical products are made from the mentioned developed chemicals. Petrochemical products include a wide range of goods which are used in everyday life in many different aspects and occasions. At the very first steps, hydrocarbons go through different chemical and physical changes in the refineries and oil and natural gas are split into the lighter compounds and this is the basic process of making petrochemical products (steemit.com 2018).

1. Petrochemical Products in Everyday Life

A large number of products that we use in our daily life are made of petrochemical derivatives. These products incorporate a large variety of outputs such as plastics, rubbers, resins, synthetic fibers, adhesives, dyes, detergents, pesticides, and petroleum-derived paints and coatings. See figure 6.

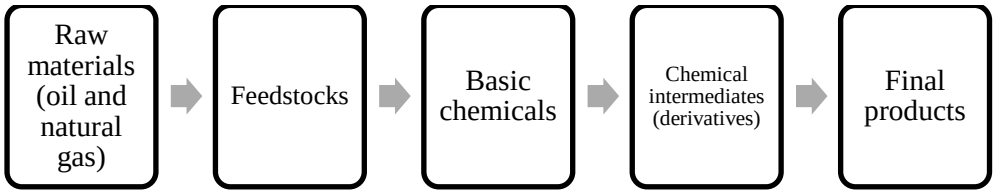
Figure 5 Petrochemical Products in Everyday Life



Source: (National Energy Board 2018)

Petrochemicals account for a high percentage of consumption of natural gas and oil. The production sequence of final petrochemical products is shown in the figure 5.

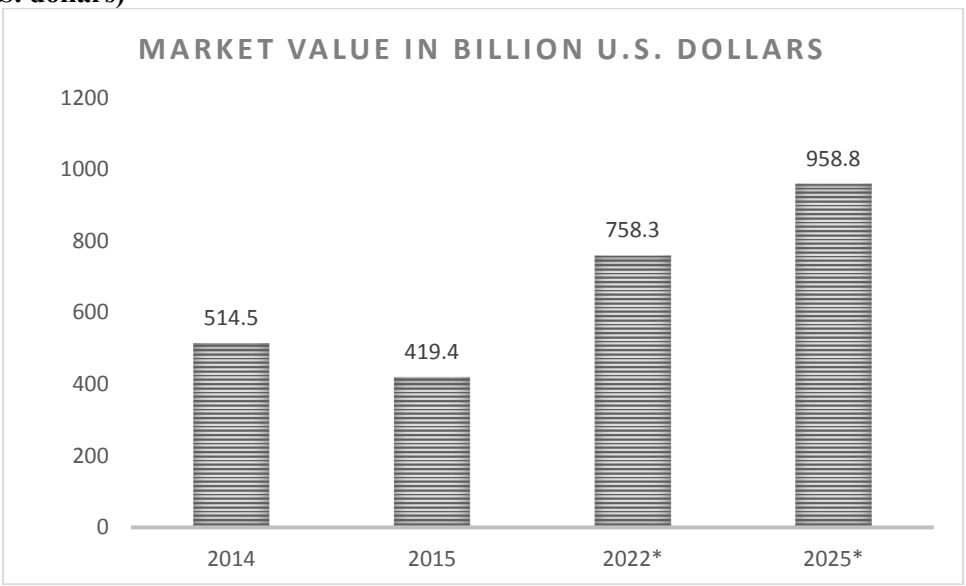
Figure 6 Petrochemicals Production Process



Source :(National Energy Board 2018)

2. Market Value of Petrochemical Industry

Figure 7 Market value of petrochemicals worldwide from 2014 to 2025 (in billion U.S. dollars)



Source**:** (statista 2019)

This graph illustrates the global market value of the petrochemical industry. In 2014, the market value of this industry was 514.5 billion U.S. dollars. This value decreased

to 419.4 billion U.S. dollars in 2015. The forecast depicts that the petrochemical market value will increase with a huge jump to 758.3 billion U.S. dollars by 2022 and this increase will continue till 2025. This forecast also indicates the high growth rate of the market value of this industry (Statista 2019).

The oil demand for the petrochemical industry will grow around 33% by 2030 and this demand is estimated to increase around 50% till 2050. Despite the fact that economies are highly dependent on the petrochemical industry, but this industry does not get enough attention. Society receives prominent advantages from this industry, such as leading edge green technologies which are vital to the energy systems. However there are some disadvantages for this industry such as air and water pollution and fundamental efforts are addressed to overcome this challenge (International Energy Agency 2018).

3. Iran's Petrochemical Industry

Iran's economy is fossil fuel based and it has a high dependency on the oil sector. Iran's petrochemical industry has been highly growing and is one the main petrochemicals centers in the world. Petrochemical industry is one of the most crucial subsets of oil industry and since Iran is one the largest oil rich countries in the world, consecutively petrochemical industry plays a vital role in the economic growth of this nation (Maitah,& Bassam, 2015).

Table 3 Top 5 oil reservoir countries in the world (2017)

Country	oil Reserves
Venezuela	17.5%
Saudi Arabia	17.2%
Canada	9.7%
Iran	9.0%
Iraq	8.50%

Source: BP statistic (2018)

According to the table 3 Iran ranks fourth among the oil rich countries and this shows the importance of oil on the economic growth of Iran.

Table 4 Top 10 countries with largest gas proved reserves (2017)

Gas Reserves
Iran
Russia
Qatar
Turkmenistan
USA
Saudi Arabia
UAE
Venezuela
China
Nigeria

Source: BP statistic (2017)

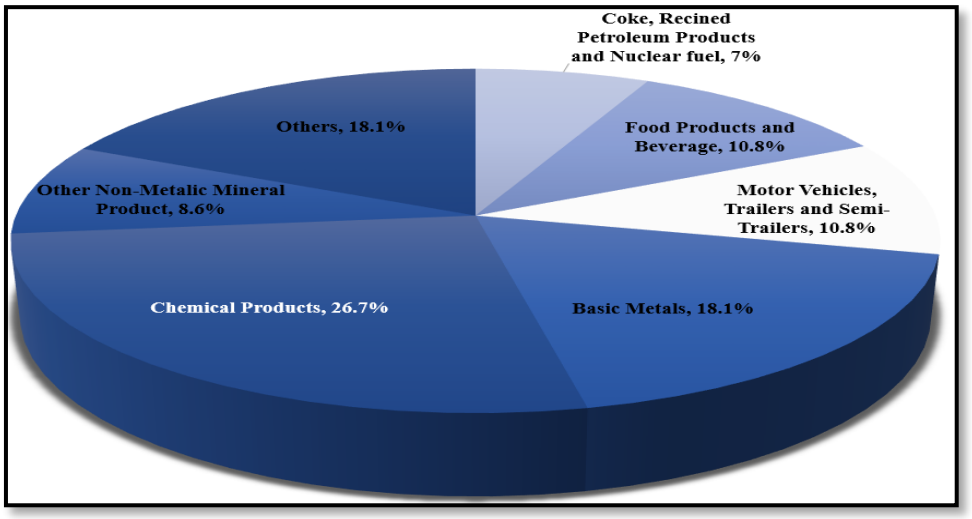
Table 4 shows the fact that Iran has the largest gas reserves in the world and this shows the high potential of Iran for a huge growth in the petrochemical industry which will lead to the economic growth.

4. The share of Petrochemical Industry in the Industrial Employment and Industrial value Added

Industrial value added which is also alluded to the gross domestic product by industry, is the share of government or private sector to the total GDP (U.S. bureau of Economic Analysis, 2006)

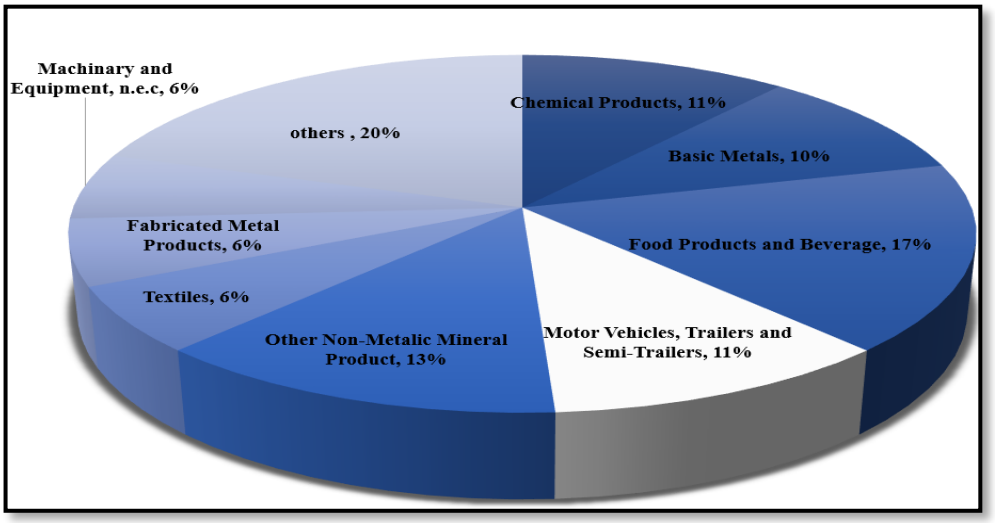
Figure 8 shows the main industries which have a prominent impact on the industrial value added of Iran. Among these seven sectors chemical products have the highest percentage and this illustrates the importance of this industry in the industrial value added growth.

Figure 8 Industrial value added



Source: Calculated by the author based on SCI [Statistical Center of Iran], (2014-15) (in Persian)

Figure 9 Employement



Source: Calculated by the author based on SCI [Statistical Center of Iran], (2014-15) (In Persian)

Figure 9 also depicts the influence of the petrochemical industry on the employment in Iran. This industry in among the top eight industries which absorb the most labors.

5. Iran's Petrochemical Industry Value Chain

Upstream, midstream and downstream market stage of the petrochemical industry act totally differently. In the upstream activities, firms look for the sources of gas and crude oil. This exploration process should be financially economic. In this process, crude oil and gas get extracted to the surface as well (cpvmfg.com).

The midstream activities incorporate the stockpiling and shipping process. Firstly, the companies collect the crude oil and gas, and then transfer it through pipelines, tanker trucks, and rail lines (cpvmfg.com).

In the third market stage, which is downstream activities, crude oil and gas are refined and converted to the petrochemicals which we use their products in our daily life. Other activities such as selling, and distributing are done in this stage too (cpvmfg.com).

Added-value, product variation, technological advancements and employment are highly different in three stages of the market which are downstream, midstream and upstream. In Iranian petrochemical industry, the main concentration is on the upstream activities which means this industry makes profit by exporting the raw materials. This is while, if these raw materials were processed domestically they could have a significant impact on the economic value added. (itsr.ir)

Despite the total increased value added of the petrochemical industry in the manufacturing sector in the recent years, still midstream and downstream activities suffer from a huge supply incapacity. Some of the key challenges that impede the shift from upstream stage to the downstream stage are as below: (itsr.ir)

- Unwise strategic management
- Inadequacy in project realization
- Limited technology transfers and localization,

- Lack of ability in attracting foreign investment and talented human resources
- Problems regarding to the price setting

Chapter III. Literature Review

1. Capital Structure Definition

Financial management is the process of obtaining, financing and monitoring the financial resources to achieve the firm's goal (Baker and Powell 2009). The long-term market value of the firm is considered as the main indicator of the firm performance and it is positively correlated with the shareholders' wealth. (Jensen, 2001). The relationship between capital structure or financing decisions and making the firm value as large as possible is one of the main concerns of financial management. Capital structure can be defined as the strategy which a firm undertakes to finance operating a business, provide assets and provide room for growth. Capital structure studies the mix of assets which company uses to finance real investments. Most of the studies done on the capital structure, assess the debt vs. equity proportions (Baker and Powell 2009). An optimal capital structure increases the stock price to its highest level and makes a balance between risk and reward. When a firm is making a capital structure, it should assess the firm's growth rates, operating leverage, taxes, asset structure, external and internal conditions, agency costs, sales, profitability, management and debt holders' policies and stability (Brigham and Houston, 2012)

2. Theorical Background

There are several conventional and unconventional theories which explore the relationship between capital structure and firm value. Almost most of the theories are

agreed on the relevancy of the capital structure and firm value but none of them is comprehensive and cannot fully justify the empirical studies (Baker & Martin, 2011). In this section, four major capital structure theories are explained.

2-1. Modigliani and Miller Theory (M&M)

M & M is derived from the name of the theorists called Modigliani and Miller who proposed this modern theory. M & M provided the ground for the other modern theories. This theory includes two propositions; the first proposition indicates that a levered firm and an unlevered firm have the same values. The second proposition shows that the higher the debt is, the higher the risk and cost of equity will be and this may lead to the bankruptcy (Modigliani & Miller 1958)

M&M theory includes some assumptions which restrict this model from being applied in the real world (Baker & Martin, 2011). In their first seminal work which was delivered in 1958, Modigliani and Miller developing their idea, considered the market, perfect and competitive. In their notion, there is no relevancy between the capital structure and firm value in the perfect market where there is no tax. They mentioned that the firm value does not change, if the capital structure changes. With any proportion of equity and debt the firm value will remain the same. Therefore the investors do not need to consider this point as a decision making criterion (Modigliani & Miller 1958). They proposed their theory based on the following assumptions:

Tax =0

Transaction cost for buying and selling securities = 0

Bankruptcy cost = 0

Asymmetric information

Same cost of borrowing for investors and firms

Modigliani and Miller modified their theory in 1963 bringing the tax in to account. In the modified version, they mentioned that firm value and capital structure are relevant and optimizing the capital structure and minimizing the cost of capital, a firm is able to increase its value. The theory illustrates an optimal capital structure to boost the firm's value. This capital structure considers more value for the firm which is levered and this prosperity comes from tax shield presence. In other words, they recommended borrowing and preferred debt rather than equity.

2-2. Theory off Theory

According to the M&M theory, in the perfect market the capital structure and the firm value are irrelevant. In their revisited theory in 1963, they added the benefits of debt tax deduction to their previous work and considered the debt ratio equal to 100 percentages. The theories which were proposed after M&M did not find the market perfect and added imperfections such as tax, transaction costs and bankruptcy to their theories. Firstly, (Kraus & Litzenberger 1973) included bankruptcy in their trade-off theory. According to them, a levered firm has more value than an unlevered firm but

consequently it has the risk of bankruptcy too. They proposed a model which evaluated the firm in a single period. In their model which is called static trade-off theory, they explained that a firm should issue debt till the point that the costs of the issuing debt can be balanced by the benefits of the tax shield. They highlighted that a firm can achieve its optimum capital structure altering its debt ratio. In this model the firm alters the amount of equity or debt to attain the OCS. But there are some criticisms on this model.

(Myers, 1984) highlighted the adjustment cost of static trade-off theory. He mentioned that there is a transaction costs when a firm is changing between debt or equity to achieve the optimum capital structure and this can be considered as another imperfection.

Also this model only considered the firm in a single period and neglected the past and the future of the firm (frank & Goyal 2005).

(Fischer, Heinkel & zechner, 1989) introduced the dynamic trade-off theory which contradicted the static Trade-off theory and tried to solve the adjustment costs of the static trade-off theory. They considered a range of the optimum capital structures which a firm can fluctuate within that range based on the situation and in this way the adjustment costs will mitigate.

2-3. Pecking-Order Theory

Pecking order theory was first proposed by (Myers, 1984). This theory did not look for an optimum capital structure. In other words, it did not seek any structure to maximize the profit and minimize the costs but tried to reduce the information asymmetry. Asymmetric information is the source of this theory. Obviously managers have more information about the firm. This information incorporates many aspects from the financial performance to the future growth of the firm. Accordingly, outsiders who can be investors or stakeholders, have less information and gain information through assessing the financial decisions of the company (Baker & Martin, 2011). Therefore the management decisions act as a signal for the outsiders, showing the performance of the firm. In this way firm communicates with stakeholders (Taj, 2016).

To avoid the asymmetric information issues, a firm should finance its asset internally. If internal financing could not work then firm can issue low risk debt and after that the high risk one. If none of the mentioned methods worked, the firm should go for the equity (Baker &Martin, 2011).

Internal financing is the best way to avoid the asymmetric information costs. When a firm issues equity, it means that the firm is working well. Therefore, the price of the equity should be more expensive than the previous ones. If the equity price is cheap, it signals that the firm performance has not been good and this intensifies the asymmetric information costs. That is why equity should be considered as the last option for financing the firm (Baker &Martin, 2011).

2-4. Agency Cost Theory

The conflict between agents and principals leads to the agency cost. An agent is appointed and authorized by the principals to make decisions. This theory stated that agents and principals not always are agreed. Agents who are managers and principals may have conflicts which these conflicts have costs which can be eliminated by applying the proper optimum capital structure (Jensen & Meckling, 1976). Sometimes agents make decisions that is based on the self-interest and do not consider the principals welfare. The asymmetric information and self-interest are the sources of this cost. Obviously managers have more information than principals do. Moreover, agents work based on the self-interest and this may lead to moral hazard too. (Eisenhardt, 1989). There are some monitoring methods which principals can apply to prevent the managers from making self-interest oriented decisions and these monitoring affairs are considered also as cost (Bebchuk & Fried, 2004).

This theory proposed that applying the high leverage, a firm can prevent the mentioned conflicts. High debt-equity ratio also encourages the managers to work in favor of the stakeholders' interest. When debt ratio is high, the amount of free cash flow decreases. That is because managers must return the interest of the debt on time. Therefore, managers are less likely to waste money and try to decrease the useless expenditures. Consecutively, managers put all their efforts to save the firm from bankruptcy and in this way they can save their own career too. Accordingly, managers will work either in favor of the firm value and the principals interest (Jensen, 1986).

The highlights of the explained capital structures are summarized in the table 5.

Table 5 Summary of the explained capital structure theories

Theory	Reference	Highlights
M & M	Modigliani and Miller (1958)	Capital Structure Irrelevance
Static Trade-off	Kraus & Litzenberger (1973)	Bankruptcy Costs
Dynamic Trade-off	Fischer, Heinkel and zechner (1989)	Adjustment Costs
Agency Costs	Jensen and Meckling (1976) Jensen (1986)	Agents & Principals Conflict Costs
Pecking Order	Myers (1984)	Asymmetric Information Costs

3. Empirical Studies

A huge number of the studies are done on the relationship between capital structure and the firm's profitability and this shows the importance of this topic. Many researchers have assessed this relationship in different countries but their results are not consistent. They have analyzed the impact of determinants of the capital structure too. The distinctive features of the firm performance and the capital structure have been studied through different methodologies which were mostly the regression analyses.

Generally, each country has its own specific structure and rules (Boorang, 2010). The inconsistency between the results of the different studies can be because of the different infrastructure of the countries.

In the table 6 you can find 48 recent studies which have investigated the capital structure of the manufacturing or service sectors in different countries over different periods of time.

Table 6 Highlights of empirical studies

Reference	Methods Sample-Region	Key Findings
Rahman et al.,2019	Panel Regression 50; Bangladesh	-Debt ratio & ROA (POS) -Equity ratio & ROA (POS) - Debt to equity ratio & ROA (NEG) - Equity ratio & ROE (POS) -Debt to equity ratio & ROE (NEG)
Thai & Hoang, 2019	Panel Regression 261; Vietnam	Proportion of block holders investment & short-term, total book and market leverage (NEG)
Ganiyu et al.,2019	Panel Regression 115; Nigeria	Capital structure & firm performance (Significant)

Lin & Zhao, 2019	Panel Regression China	-The share ratio of the largest shareholder & performance (NEG); -The proportion of the top ten shareholders & Performance (NEG)
Ahmad et al., 2019	Multiple Regressions 240; Globe	-Liquidity, interest coverage ratio ,growth & debt to -Equity ratio (NEG) -Size of firm & profitability (POS)
Martinez et al, 2019	Review Paper	Some key aspects about the capital structure of firms and SMEs are identified
Muritala,2018	Panel Regression 10; Nigeria	Asset tangibility & ROA (NEG)
Goh et al., 2018	Panel Regression 174; Malaysia	Firm profitability & leverage (NEG)
Akingunola, 2018	Panel Regression 22; Nigeria	-Debt &firm performance (POS) –Debt holder (NEG).

Nenu et al., 2018	Panel Regression 51; Romania	-Leverage & company performance (POS) –Debt structure & corporate performance (NEG)
Musah, 2018	Panel Regression 23; Ghana	-Short term debt ratio , long term debt ratio & profitability (NEG) -Total debt ratio & profitability (POS)
Akhter,2018	Panel Regression 35; India	Short-term debt ratio ,total debt ratio to & ROE (POS)
Sivalingam & Kengatharan, 2018	Panel Regression 10; Sri Lanka	Total debt ratio & ROA (NEG) -Growth in banks deposit & ROA (POS)
Siddik et al., 2017	pooled ordinary least square analysis 22; Bangladesh	Capital structure inversely affects bank performance

Mallisa & Kusuma, 2017	Panel Regressions 94 Indonesian; 153 Malaysian; and 74 Thailand firms	Company's profitability, firm size and volatility have dominant and consistent roles in explaining the variation of the capital structure
Aggarwal & Padhan, 2017	Panel Regression 22; India	A significant relationship of firm value with firm quality, leverage, liquidity, size and economic growth
Vo & Ellis, 2017	Multivariate regressions 1214 ; Vietnam	financial leverage & shareholder value (NEG)
Nhung et al., 2017	Panel regression 34;Vietnam	Short term and long term debt ratio & capital Structure (POS)
Kumar et al., 2017	Paper Review	An increase of interest in research on determinants of capital structure of the firms located in emerging markets
Nassar, 2016	Panel Regressions 136; Turkey	Capital structure & firm performance (NEG)

Dada & Ghazali, 2016	Panel Regression 100; Nigeria	-Assets turnover & Tobin's Q (POS) -Risk & Tobin's Q (NEG)
UDEH et al, 2016	Panel Regression 43; Nigeria	Debt structure & performance (NEG)
Hossain & Nguyen, 2016	Panel Regression 10; Canada	Leverage & performance (NEG)
Imtiaz et al., 2016	Panel Regression 8; Bangladesh	This empirical analysis finds that the static trade-off theory and the pecking order theory are the most dominant capital structure theories for the pharmaceutical firms of Bangladesh.
Habib & Wazir, 2016	Panel Regression 340; Pakistan	Debt & profitability (NEG)
Ahmad & Ali, 2016	Panel Regression 14; Pakistan	Leverage & firms' financial performance
Kakanda et al., 2016	Panel Regression 7; Nigeria	-Short-term debt & (ROE) (NO Impact) –Long-term debt & ROE (POS)

Mauwa et al., 2016	Panel Regression 6; Rwanda	Capital structure & financial performance (NEG)
Nasimi, 2016	Panel Regression 30; London	Interest Coverage & ROA, ROE (POS)
Zeitun, & Tian,2014	Panel Regression 167; Jordan	capital structure & firm's performance (NEG)
Maina & Ishmail, 2014	panel Regression Kenya	capital structure & leverage (NEG)
Dawar, 2014	Panel Regression 100; India	Leverage & financial performance (NEG)
Muhammad et al., 2014	Panel Regression 25; Pakistan	Capital structure and firm performance (NEG)
Sheikh & Wang, 2013	Panel Regression 240; Pakistan	Debt ratios & ROA (NEG)
Iavorskyi, 2013	Panel Regression 16.5thousand; Ukraine	Leverage and firm performance (NEG)
Rajendran & Nimalthasan, 2013	Panel Regression 287; Sri Lanka	ROE and ROA are not significantly Correlated with debt equity ratio
Salim & Yadav, 2012	Panel Regressions 237; Malaysia	ROA and ROE & debt ratios (NEG)

Chinaemerem & Anthony, 2012	Pooled Ordinary Least Square regression 30; Nigeria	Debt Ratios &ROE and ROA (NEG)
Khan, 2012	Pooled Ordinary Least Square regression 36; Pakistan	Short-term debt ratio ,total debt ratio & ROA and ROE (NEG)
Pouraghajan et al., 2012	Pearson correlation and estimation of multiple regression models 400; Iran	-Debt ratio & financial performance (NEG) –Asset turnover, firm size, asset tangibility ratio, and growth opportunities & financial performance measures (POS)
Memon et al., 2012	Log linear regression model 141; Pakistan	All the determinants of capital structure are significant
Ahmad et al., 2012	A series of regression analysis 58; Malaysia	-Short-term debt ratio ,total debt ratio & ROA (SIGNIFICANT) All debt ratios &ROE (SIGNIFICANT)
Soumadi & Hayajneh, 2012	Panel Regression 76; Jordan	Capital structure & firm performance (NEG)

Ebaid, 2009	Panel Regression 64; Egypt	Capital structure & firm's performance (NEG)
Abor, 2007	Panel Regression 68 ; Ghana	capital structure & firm performance (NEG)
Abor, 2005	Panel Regression 2; Ghana	Ratio of short-term debt & ROE (POS)
Thomsen & Pedersen, 2000	Panel Regression 435; Europe	Ownership concentration & ROA (POS)
Chaganti & Damanpour, 1991	Multiple Regressions 40; United States	stockholdings & firm's capital structure (SIGNIFICANT)

All these studies present valuable results but the results are not similar and do not move in the same direction. As it was mentioned before, this study will analyze the profitability ratios, ROA and ROE. And the below studies are some examples that have done the same job in different countries.

(Abor, 2005) shows strong relationship between SHTD and ROE. (Ahmad et al., 2012) depict SHTD and TOTD have a significant impact on ROA while all debt ratios have a significant impact on ROE. (Khan, 2012) indicates a significant negative relationship between TOTD and SHTD and ROE and ROA. (Chinaemerem & Anthony, 2012) and (Salim & Yadav, 2012) and (Iavorskyi, 2013) and (Maina & Ishmail, 2014) and (Ahmad & Ali, 2016) and (Habib & Wazir, 2016) and (Hossain & Nguyen, 2016) and

(UDEH et al, 2016) and (Vo & Ellis, 2017) show that there is a significant relationship between debt ratios and ROE and ROA. (Sheikh & Wang, 2013) results suggest a negative relationship between debt ratios and ROA.

4. Research Objectives

This study aims to achieve the following objectives:

1. Assessing the Impact of Capital Structure on the petrochemical complexes profitability.
2. Recommending appropriate policy implications to improve the petrochemical complexes' overall profitability especially in the downstream activities.

5. Research Contribution

Despite there are many valuable studies in this field, still there is room for more research. Many studies have been implemented in different sectors and industries within different countries applying different methods but none of them has focused specifically on the downstream side of the petrochemical projects in Iran which has room for growth and has a significant role in the employment and value added of Iran's economy. This study will assess the capital structure of the Iranian petrochemical complexes and its impact on ROE and ROA of the complexes and will provide policy implications.

Chapter IV. Methodology

This study analyzes the impact of financial ratios on the Return on assets and return on equity. This study mainly follows (Vătavu, 2015) work which analyzed the impact of capital structure on the Romanian firm performance.

1. Data

In this study 22 listed petrochemical complexes are evaluated. All the samples are chosen from Iran's National Petrochemical Company website. There are 52 petrochemical complexes in total but because of the lack of data availability only 22 of them are eligible. The sample includes a period of seven years from 2011/2012 to 2017/2018. Since Iranian Fiscal year is based on the Iranian solar calendar, the dates do not exactly match the Gregorian calendar.

2. Variables

The classification of variables is summarized in table 7. Two financial metrics, return on assets (ROA) and return on equity (ROE) are selected as the dependent variables. These two performance indicators show the amount of profit that a firm can make based on its asset investments, and the efficient approaches for managers to use investors' funds.

Table 7 variables identification

Variables	Ratios	
Dependent	ROA	Net Income / Total Assets
	ROE	Net Income/ Shareholders'
Independent	TOTD	Total Liabilities / Total Assets
	LGTD	Long-Term Liabilities / Total Assets
	SHTD	Short-Term Liabilities / Total Assets
	ET	Total Equity / Total Assets
Control	BUSRISK	Standard Deviation Of Earnings Before Interest And Tax / Total Assets,
	TANG	Fixed Assets/ Total Assets
	INFL	Provided By Central Bank Of Iran.
	Liquidity	current assets / current liabilities

Source**: (**Vătavu, 2015)

3. Empirical Model

In this study the variables which impact the firm performance on a time series cross-sectional data from 2011/2012 to 2017/2018 will be studied. (Vătavu, 2015) regressed

ROA and ROE on some variables and accordingly introduced the firm performance determinants as follows:

Profitability= *f* (debt, equity, tangibility, business risk, liquidity, inflation)

The following equations show the static linear models:

$$ROA_{it}=\alpha_i+\beta_1 \text{CapStr}_{it}+\beta_2 Tang_{it}+\beta_3 Tax_{it}+\beta_4 BusRisk_{it}+\beta_5 Liquid_{it}+\beta_6 Infl_{it}+\varepsilon_{it} \quad (2)$$

$$ROE_{it}=\alpha_i+\beta_1 \text{CapStr}_{it}+\beta_2 Tang_{it}+\beta_3 Tax_{it}+\beta_4 BusRisk_{it}+\beta_5 Liquid_{it}+\beta_6 Infl_{it}+\varepsilon_{it} \quad (3)$$

Where unknown intercept for each firm is represented by α_i(i = 1...22), the year assessed is shown by t (t=2011/2012 – 2017/2018), the coefficients for each independent variable are determined by β_s, the error term is ε_{it} and CapStr stands for the four mentioned capital structure ratios .Only one of the capital structure ratios can be applied to run the regression, otherwise autocorrelation might happen.

4. Multiple Regressions

Figure 10 Multiple Regressions

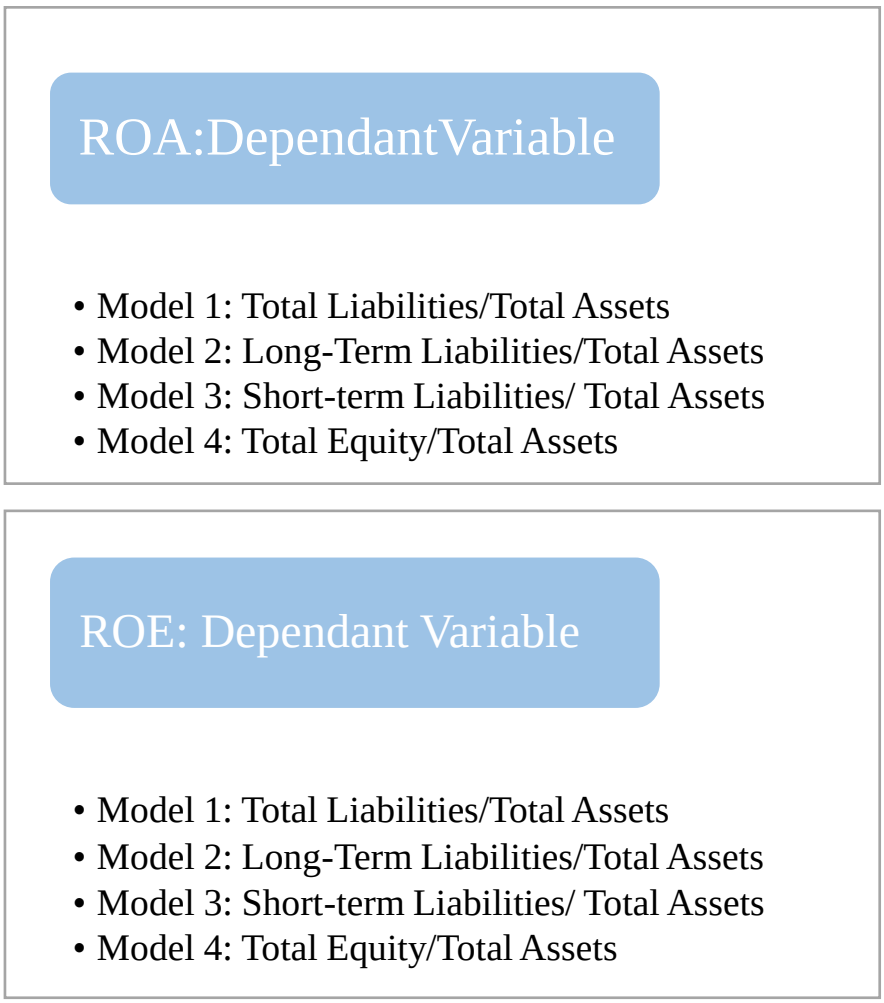


Figure 10 shows eight different models which will be run in this research. These models include debt ratios and equity ratio and they will be separately regressed on ROA and ROE.

5. Model Selection Criteria

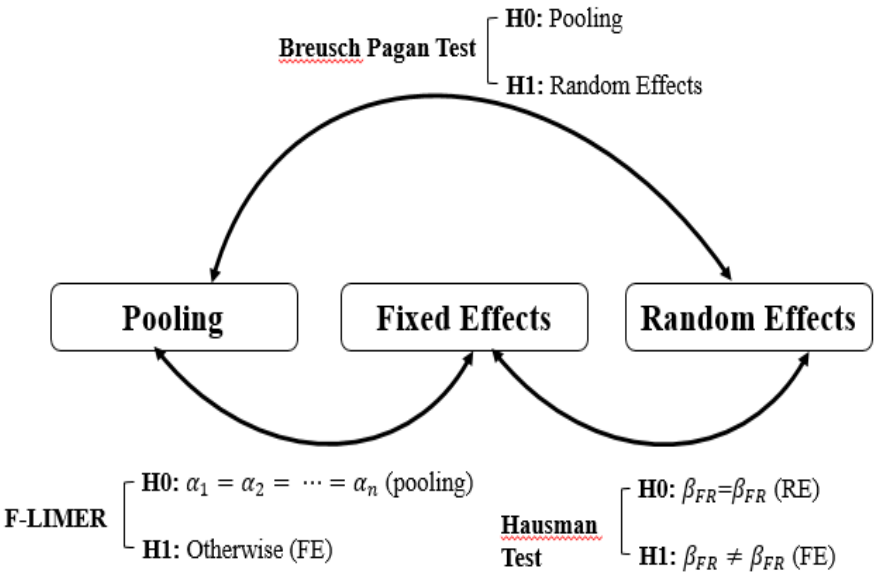


Figure 11 Model Selection Criteria

Pooled Ordinary Least Squares, Fixed Effects and Random Effects are the methods which are applied to examine the considered static models. To determine the appropriate test between Fixed Effects and Random Effects, the Hausman test is run.

6. Results

Dependent Variable: ROA

Table 8 Results of Model 1

	Fixed Effect	Random Effect	Selected
Infl	13.006 [0.000]	.317 [0.197]	Random Effect
totd	1.589 [0.000]	1.036 [0.000]	
busrisk	.029 [0.000]	.068 [0.000]	
tang	-1.151 [0.000]	-.615 [0.000]	
liquid	3.172 [0.000]	3.125 [0.000]	
CONS	4.176 [0.000]	4.258 [0.000]	
F-Limer	41.23 [0.000]		
Hausman Chi(2)		233.03 [0.000]	
Number of Observations	154		
R-squared	0.9954		

Table 9 Results of Model 2

	Fixed Effect	Random Effect	Selected
Infl	3.046 [0.000]	.092 [0.584]	Random Effect
lgtd	.0187 [0.000]	.018 [0.000]	
busrisk	.142 [0.000]	.144 [0.000]	
tang	.279 [0.000]	.280 [0.000]	
liquid	2.276 [0.000]	2.308 [0.000]	
Cons	2.755 [0.000]	2.836 [0.000]	
F-Limer	3.84 [0.001]		
Hausman Chi(2)		15.97 [0.006]	
Number of Observations	154		
R-squared	0.9944		

Table 10 Results of Model 3

	Fixed Effect		Selected
Infl	-4.852 [0.038]		Fixed
shtd	.2328 [0.010]		
busrisk	.0367 [0.272]		
tang	.198 [0.017]		
liquid	3.554 [0.000]		
Cons	5.017 [0.000]		
F-Limer	1.93 [0.080]*		
Hausman Chi(2)		3.03 [0.694]	
Number of Observations	154		
R-squared	0.9649		

Table 11 Results of Model 4

	Fixed Effect	Random Effect	Selected
Infl	6.693 [0.000]	.165 [0.519]	Random
te	-.825 [0.000]	-.660 [0.000]	
busrisk	.028 [0.000]	.051 [0.000]	
tang	1.286 [0.000]	1.106 [0.000]	
liquid	4.306 [0.000]	4.054 [0.000]	
cons	6.202 [0.000]	5.851 [0.000]	
F-Limer	5.76 [0.000]		
Hausman Chi(2)		24.87 [0.000]	
Number of Observations	154		
R-squared	0.9948		

To assess the impact of independent and control variables on ROA, four regressions were run. The Hausman test suggests the random effects models for the independent variables TOTD, LGTD and TE while fixed effects model is proposed for the SHTD model at 1% significant level. The regressions' results show that among four independent variables TOTD has a positive significant impact on ROA while TE has a negative impact on it. LGTD and SHTD have a weak impact on ROA. The results show that increase of TOTD by one unit raises the Iranian petrochemical companies' ROE about 1.036 units. On the contrary, increase of a unit of TE will lead to 0.660 unit decrease of ROA.

Among the control variables, liquidity has a significant positive impact on ROA. This variable has its most impact on ROE in the fourth regression. With increase of a unit of liquidity in the fourth regression, ROA will increase about 4.306 units. Followed by liquidity, tangibility has a significant impact only in the fourth regression and it has a weak impact on ROA in other three regressions. Inflation has a significant negative impact on ROA in the third regression. The results do not show any significant impact on BUSRISK in any of the regressions.

Dependent Variable: ROE

Table 12 Results of Model 5

	Fixed Effect	Random Effect	Selected
infl	7.808 [0.000]	.083 [0.522]	Random
totd	2.296 [0.000]	1.959 [0.000]	
busrisk	-.082 [0.000]	-.059 [0.000]	
tang	-1.611 [0.000]	-1.285 [0.000]	
liquid	1.021 [0.000]	.993 [0.000]	
Cons	.873 [0.000]	.923 [0.000]	
F-Limer	16.79 [0.000]		
Hausman Chi(2)		89.92 [0.000]	
Number of Observations	154		
R-squared	0.9954		

Table 13 Results of Model 6

	Fixed Effect	Random Effect	Selected
infl	-6.556 [0.000]	-.079 [0.635]	Random
lgtd	.027 [0.000]	.028 [0.000]	
busrisk	.079 [0.000]	.076 [0.000]	
tang	.454 [0.000]	.451 [0.000]	
liquid	-.275 [0.000]	-.344 [0.000]	
Cons	-1.188 [0.000]	-1.366 [0.000]	
F-Limer	14.20 [0.000]		
Hausman Chi(2)		77.35 [0.000]	
Number of Observations	154		
R-squared	0.9946		

Table 14 Results of model 7

	Fixed Effect	Random Effect	Selected
infl	-11.255 [0.001]	.267 [0.271]	Random
shtd	-.019 [0.873]	-.326 [0.000]	
busrisk	.055 [0.236]	.161 [0.000]	
tang	.664 [0.000]	.951 [0.000]	
liquid	.668 [0.050]	-.131 [0.598]	
Cons	.700 [0.217]	-.568 [0.193]	
F-Limer	2.91 [0.010]		
Hausman Chi(2)		11.98 [0.0351]	
Number of Observations	154		
R-squared	0.9649		

Table 15 Results of Model 8

	pooled	**selected**
infl	.009 [0.920]	**Pooled**
te	-1.463 [0.000]	
busrisk	-.115 [0.000]	
tang	2.194 [0.000]	
liquid	3.106 [0.000]	
CONS	4.501 [0.000]	
F-LIMER	1.35 [0.238]	
Number of Observations	154	
R-squared	0.9948	

The relationship between ROE as another main indicator of Iranian petrochemical firms' performance and other independent and control variables is assessed in other four regressions. Three first regressions which include TOTD, LGTD and SHTD are suggested to be random effects models based on the hausman test results. The fourth regression which regresses the variable TE, is proposed to be a pooled model based on the f-limer test. The results indicate that none of the debt ratios has a significant impact on ROE while TE has a significant negative impact on this variable. With increase of a unit of TE, ROE will decrease about 1.463. Among debt ratios, SHTD has a weak negative impact on ROE and this is while LGTD and TOTD have a weak positive impact on it. Among control variables, tangibility has a significant negative impact on

ROE in regression which regresses TOTD while it has a significant positive impact on ROE while TE is regressed. Table 16 answers the first research question of this study.

Table 16 Summary of the Main Results

Variables	ROA	ROE
TOTD	Positively Significant	Positively Significant
LGTD	Not Any Significant Impact	Not Any Significant Impact
SHTD	Not Any Significant Impact	Not Any Significant Impact
TE	Negative	Significantly negative
INFL	Not any significant impact	Not Any Significant Impact
BUSRISK	Not any significant impact	Not Any Significant Impact
TANG	Positive	Mix Significant Impacts
LIQUID	Strongly Positive	Mix Significant Impacts

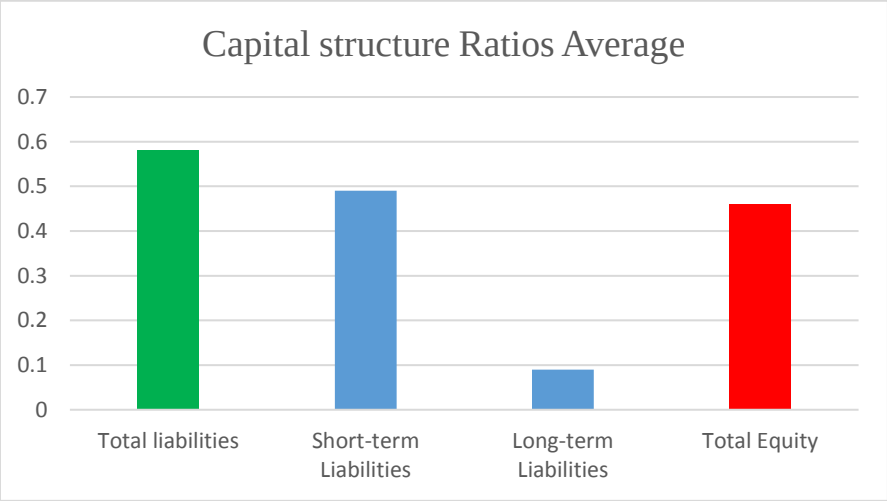
The second question of this study, looks for the reasons behind the lack of the progress and advancement of Iranian petrochemical complexes. According to (Boorang, 2010) 60% of petrochemical companies use debt to finance their assets and about 80% of this debt is financed by short term liabilities. As it is depicted in the table 14, SHTD positively impacts ROA and negatively impacts ROE but this impact is not strong. This type of capital structure can be one of the underlying reasons which impedes the successful performance of the petrochemical complexes.

7. R-Squared

The measure, R-squared illustrates the distance between fitted line and data (minitab.com 2013). As it is shown in the regression results' table, the R- Squared value is large in all models and this is because of the data standardization. The scattered data from the fitted line resulted the pooled model for ROE variable. In order to fix this model, the mean was subtracted from values and divided by standard deviation and that is why the data got close to the fitted line and consecutively R-squared showed a large value.

Figure 12 demonstrates that Iranian petrochemical complexes mainly use total debt as their capital structure.

Figure 12 Capital Structure Comparison



Chapter V. Overall Conclusion and Recommendations

5. Conclusion

Capital structure has a crucial impact on the firm effectiveness and profitability. An appropriate capital structure can maximize the firm's profit. In the global competitive markets, petrochemical industry value is highly increasing. Petrochemical industry of Iran is not moving with the world growth' speed of this field. Iran lags in the downstream projects of this industry and requires fundamental modifications. Budget and technology deficiency can be mitigated by an appropriate capital structure choice. Iran's current capital structure is using both debt and equity almost equally while the long term debt is the structure which will boost this sector's effectiveness.

5-1. Recommendations and Policy Implications

The economic sanctions which were imposed to Iran, weakened the economy of this developing country deeply (cnbc.com 2019). The affecting factors of the developing countries capital structure choice from one hand and the economic recession from the other hand, negatively impact the capital structure choice. Based on the results, it is recommendable that Iranian petrochemical complexes applying the total debt become highly levered. But as the economic infrastructure of Iran may not support the risks accompanied with debt, this strategy must be applied with caution. The provision of a

sound cash saving which can afford the debt interest rate is a vital policy. While Iran's inflation is growing with a rate above 40% (IMF 2019), the bankruptcy risk should come to a serious consideration. Decreasing the cash flow and liquidity may be one of the policies which can support the debt strategy. The issue surrounding applying debt strategy is the significant interference of the government in the banking affairs. Loans from the banks place in the main stream of the source of the financing meanwhile the government has a notable control over the banks and it can be a serious issue. Therefore, this lack of control over external and governmental interference should be taken into account while adjusting the optimal capital structure.

Also it is suggested that the petrochemical complexes increase their current assets to raise their profitability. Since equity has a negative impact on ROA and ROE of these complexes, it is suggested that they reconsider the equity proportion in their capital structure. Applying debt as the financial resource, complexes are able to avoid the agency costs as well. When return on assets and return on equity increases, consecutively, the reputation of the complexes will increase and this can attract investors and boost the complexes credit in the debt holders' eyes. Also with the insecure situation of investment in Iran, Petrochemical complexes are expected to enhance the investors' right protection.

5-2. Future Research

Since capital structure is formed by debt and equity, an optimum proportion should be determined. Future studies can find the appropriate proportion of debt and equity which can maximize the complexes profit.

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자본 구조 및 기업 성과

이 연구는 이란의 증권거래소에 상장 된 22 개 이란 석유화학그룹들의 자본구조와 재무성과 간의 관계를 다루고 있다. 이 연구는 2011-2017 년 기간을 대상으로 패널 데이터 분석을 시행하였다. 자본구조의 지표로 장기부채, 단기부채, 총부채 및 총자본을 고려하였으며, 성과지표로 자기자본수익률과 자산수익률을 선택하였다. 한편 인플레이션, 위험성, 유형성 및 유동성을 포함한 제조 공업의 자본구조 결정요인들을 통제변수로 사용하였다. 주요 결과 중의 하나는, 부채가 자기자본수익률과 자산수익률에 긍정적인 영향을 미치지만 총자본에 부정적인 영향을 미친다는 것이다. 한편 자본구조 결정요인들은 자산수익성에 대해 혼합된 효과를 나타내고 있다. 이란 석유화학그룹들의 현재 자본구조와 본 연구의 결과를 기반으로, 이란 석유화합그룹들은 수익성을 증진시키기 위해 장기부채를 늘려야하고 단기부채를 줄여야한다는 정책적 시사점을 제시할 수 있다.

중요어: 자본구조, 기업성과, 석유화학그룹, 패널데이터, 자산수익률, 이란